

Amendments to the Claims

This listing of claims will replace all prior versions, and listing, of claims in the application:

1. (Previously Amended) A pipe structure comprising a flexible pipe connected to an end fitting, the flexible pipe comprising an armour layer and an underlying pipe layer to said armour layer, said underlying pipe layer having an outer surface around which armouring wires of an armouring layer are wound, the flexible pipe having a longitudinal axis, wherein said end fitting comprises:

one or more anchoring elements adapted for anchoring at least one of said armouring wires, and

a support unit arranged coaxially around said underlying pipe layer;

at least one of said armouring wires comprising

a conforming-wire-pipe-section forming a helical path and conforming to the outer surface of said underlying pipe layer of said flexible pipe at least over a part of its length, and

a wire-end-fitting-section;

said two wire sections extending in opposite directions from a wire-pipe-exit-point where said armouring wire separates tangentially away from said underlying pipe layer; and

said wire follows an essentially straight line of a length L_{free} between said wire-pipe-exit-point and a straight-line-end-point on said support unit, said essentially straight

line part of the wire being defined as the straight-line-section, and said straight-line-part is essentially unsupported between said wire-pipe-exit-point and said straight-line-end-point on said support unit.

2. (Original) A pipe structure according to claim 1 wherein said wire-end-fitting-section is arranged to follow a predefined termination path between said wire-pipe-exit-point and one of said anchoring elements when said pipe structure is in an unloaded condition.

3. (Cancelled)

4. (Previously Presented) A pipe structure according to claim 1, wherein said straight-line-section extends away from said longitudinal axis when viewed from said wire-pipe-exit-point.

5. (Previously Presented) A pipe structure according to claim 1, wherein said straight-line-section of said armouring wire has a tangential point of contact with said support unit in said straight-line-end-point.

6. (Previously Presented) A pipe structure according to claim 1, wherein said underlying pipe layer of said flexible pipe comprises an armouring reinforcement on a section of the pipe structure including said wire-pipe-exit-point and extending in a

direction of the end fitting as defined by a direction from the flexible pipe towards the end fitting.

7. (Previously Presented) A pipe structure according to claim 2, wherein said predefined termination path further comprises a supported-wire-section running on the outer surface of said support unit from said straight-line-end-point to a support-unit-exit-point where the armouring wire leaves the surface of said support unit for being locked in one of said anchoring elements, said supported-wire-section essentially constituting a geodetic curve between said straight-line-end-point and said support-unit-exit-point on said outer surface of said support unit.

8. (Previously Presented) A pipe structure comprising a flexible pipe connected to an end fitting, the flexible pipe comprising an armour layer and an underlying pipe layer to said armour layer, said underlying pipe layer having an outer surface around which armouring wires of an armouring layer are wound, the flexible pipe having a longitudinal axis, wherein said end fitting comprises:

one or more anchoring elements adapted for anchoring at least one of said armouring wires; and

a support unit arranged coaxially around said underlying pipe layer;

at least one of said armouring wires comprising

a conforming-wire-pipe-section forming a helical path and conforming to the outer surface of said underlying pipe layer of said flexible pipe at least over a part of its length, and

a wire-end-fitting-section,
said two wire sections extending in opposite directions from a wire-pipe-exit-point where said armouring wire separates tangentially away from said underlying pipe layer; and
said wire follows an essentially straight line of a length L_{free} between said wire-pipe-exit-point and a straight-line-end-point on said support unit, said essentially straight line part of the wire being defined as the straight-line-section; and
wherein the support unit comprises elements arranged to receive individual armouring wires.

9. (Previously Presented) A pipe structure according to claim 8 wherein the support unit has a supporting surface, and the supporting surface of said support unit where said straight-line-end-point is located is individually formed for different wires having their straight-line-end-point located on said support unit.

10. (Original) A pipe structure according to claim 9 wherein the supporting surface of a wire is a single curved surface oriented normal to the pipe tangent plane of the wire, containing the said straight-line-section of said wire.

11. (Previously Presented) A pipe structure according to claim 1, wherein said support unit has an outer surface that describes a surface of revolution with an axis of revolution that coincides with the longitudinal axis of the flexible pipe.

12. (Previously Presented) A pipe structure comprising a flexible pipe connected to an end fitting, the flexible pipe comprising an armour layer and an underlying pipe layer

to said armour layer, said underlying pipe layer having an outer surface around which armouring wires of an armouring layer are wound, the flexible pipe having a longitudinal axis, wherein said end fitting comprises:

one or more anchoring elements adapted for anchoring at least one of said armouring wires; and

a support unit arranged coaxially around said underlying pipe layer;

at least one of said armouring wires comprising

a conforming-wire-pipe-section forming a helical path and conforming to the outer surface of said underlying pipe layer of said flexible pipe at least over a part of its length, and

a wire-end-fitting-section,

said two wire sections extending in opposite directions from a wire-pipe-exit-point where said armouring wire separates tangentially away from said underlying pipe layer; and

said wire follows an essentially straight line of a length L_{free} between said wire-pipe-exit-point and a straight-line-end-point on said support unit, said essentially straight line part of the wire being defined as the straight-line-section; and

wherein said support unit has an outer surface which includes a part of a torus on which the straight-line-end-point is located.

13. (Previously Presented) A pipe structure according to claim 1, wherein said support unit has a convex part with an outer surface with an outward curvature and said straight-line-end-point is located on said convex part of the support unit.

14. (Previously Presented) A pipe structure comprising a flexible pipe connected to an end fitting, the flexible pipe comprising an armour layer and an underlying pipe layer to said armour layer, said underlying pipe layer having an outer surface around which armouring wires of an armouring layer are wound, the flexible pipe having a longitudinal axis, wherein said end fitting comprises:

one or more anchoring elements adapted for anchoring at least one of said armouring wires; and

a support unit arranged coaxially around said underlying pipe layer;

at least one of said armouring wires comprising

a conforming-wire-pipe-section forming a helical path and conforming to the outer surface of said underlying pipe layer of said flexible pipe at least over a part of its length, and

a wire-end-fitting-section,

said two wire sections extending in opposite directions from a wire-pipe-exit-point where said armouring wire separates tangentially away from said underlying pipe layer; and

said wire follows an essentially straight line of a length L_{free} between said wire-pipe-exit-point and a straight-line-end-point on said support unit, said essentially straight line part of the wire being defined as the straight-line-section; and

wherein said support unit comprises at least a first and a second body, said first body of the support unit has an outer surface which includes a part of a torus, and said second body has an outer surface that describes a surface of revolution, both surfaces

having the same axis of revolution, said axis coinciding with the longitudinal axis of the flexible pipe, and both surfaces having coinciding tangents in a joining point in a cross sectional plane including the axis of revolution.

15. (Original) A pipe structure according to claim 14 wherein said second body comprises guiding elements for guiding armouring wires received from said first body.

16. (Previously Presented) A pipe structure according to claim 1, wherein said anchoring elements for locking said armouring wires to said end-fitting are distributed on one or more terminating parts.

17. (Original) A pipe structure according to claim 16 wherein the flexible pipe comprises more than one armouring layer and separate support units and terminating parts are allocated to each layer.

18. (Previously Presented) A pipe structure according to claim 1, wherein said straight-line-section of an armouring wire is surrounded by a material which does not substantially alter the deformation behaviour of the flexible pipe and the wire.

19. (Previously Presented) A pipe structure according to claim 1, wherein the flexible pipe is an un-bonded flexible pipe comprising a tube formed liquid tight inner liner and one or more armour layers.

20. (Previously Presented) A pipe structure according to claim 1, wherein said flexible pipe comprises two layers of helically wound armouring wires, the winding angles with respect to the longitudinal direction of the flexible pipe being between 50 and 60 degrees.

21. (Previously Presented) A pipe structure according to claim 1, wherein said armouring wire or wires are made of a composite material.

22. (Previously Presented) A pipe structure according to claim 1, wherein said armouring wire or wires are in the form of a layered wire comprising two or more layers of materials which may be identical or different from each other.

23. (Previously Presented) A pipe structure according to claim 22 wherein said armour layers of the wire or wires are made from one or more of the materials selected from the group consisting of metals, thermoplastic polymers, and thermosetting polymers.

24. (Previously Presented) A pipe structure according to claim 1, wherein said armouring wire or wires is/are in the form of a layered wire comprising two or more layers of materials which layers being held together by a wrapping material and/or by adhesive forces.

25. (Previously Presented) A pipe structure according to claim 1, wherein the or each armour layer comprises one or two or a multitude of armouring wires.

26. (Previously Presented) A pipe structure according to claim 1, wherein said armouring wire(s) is/are flat, said wire or wires having a square formed cross section.

27. (Previously Presented) A pipe structure according to claim 1, wherein each of the layers of the flexible pipe are fixed to said end-fitting.

28. (Previously Presented) A pipe structure according to claim 1, wherein said end-fitting comprises an axially extending through opening, said armouring wire or wires being supported by the outer surface of said support unit, wherein the outer surface means the surface turning away from the axially extending through opening.

29. (Previously Presented) A pipe structure according to claim 1, wherein the armouring wire or wires is/are anchored by being embedded in a casting material.

30. (Previously Presented) A pipe structure according to claim 1, wherein the end-fitting comprises one or more locking cavities, said armouring wire or wires is/are anchored in said locking cavity or cavities.

31. (Previously Presented) A pipe structure according to claim 30 wherein the armouring wire or wires are anchored by a spreader element driven into the wire or wires in said locking cavity or cavities.

32. (Currently Amended) A pipe structure comprising a flexible pipe connected to an end fitting, the flexible pipe comprising an armour layer and an underlying pipe layer to the armour layer, the underlying pipe layer having an outer surface around which armouring pipes of an armouring layer are wound, the flexible pipe having a longitudinal axis, wherein the end fitting comprises:

one or more anchoring elements adapted for anchoring at least one of the armouring wires, and

a support unit arranged coaxially around the underlying pipe layer;

at least one of the armouring wires comprising:

a conforming-wire-pipe-section forming a helical path and conforming to the outer surface of the underlying pipe layer of the flexible pipe at least over a part of its length, and

a wire-end-fitting-section;

the two wire sections extending in opposite directions from a wire-pipe-exit-point where the armouring wire separates tangentially away from the underlying pipe layer; and

the wire follows an essentially straight line of a length L_{free} between the wire-pipe-exit-point and a straight-line-end-point on the support unit, the essentially straight line part of the wire being defined as the straight-line-section;

wherein the end-fitting comprises one or more locking cavities, the armouring wire or wires being anchored in the locking cavity or cavities, wherein at least one locking cavity has a length dimension defined as the length dimension of a wire mounted in the locking cavity, and the cross sectional area perpendicular to the length of the locking cavity differs along its length in one or more steps or continuously, wherein a first cross sectional area perpendicular to the length of the locking cavity is smaller than a second cross sectional area perpendicular to the length of the locking cavity, wherein the first cross section is closer to the support unit than the second cross section.

33. (Original) A pipe structure according to claim 32 wherein the armouring wire or wires is/are anchored by use of a spreader element driven into the wire or wires in the part of said locking cavity or cavities where a first cross sectional area perpendicular to the length of the respective locking cavity is larger than a second cross sectional area perpendicular to the length of the respective locking cavity, the second cross section being taken closer to the support unit than the first.

34. (Previously Presented) A pipe structure according to claim 1, wherein the armouring wire or wires is/are anchored to the end-fitting by use of a spreader element driven into the wire to thereby spread the wire into two or more laminates whereby the laminated wire or wires is fixed against the wall or walls of a locking cavity formed in the end-fitting.

35. (Previously Presented) A pipe structure according to claim 1, wherein the flexible pipe comprises two armour layers and the end fitting comprises two annular support units, the wire or wires of a first armour layer being supported by a first annular support unit, and the wire or wires of a second armour layer being supported by a second annular support unit.

36. (Previously Presented) A pipe structure according to claim 1, wherein the pipe structure comprises a reinforcement sleeve layer placed below the one or more armouring layer or layers, and said reinforcement sleeve layer extends along the pipe structure in a length which includes the section of the pipe structure between the wire-pipe-exit-point and the straight-line-end-point.